

# VIRGIN COCONUT OIL AS ANTIOXIDANT AND TREATMENT ON METABOLIC DISORDERS: A SHORT REVIEW

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## ABSTRACT

Coconut (*Cocos nucifera*) is among the most nutritious plant and has been used extensively as food and for various industrial purposes since thousand years ago. The coconut oil is remarkable for its nutritional value as it contains high nutrients, vitamins and minerals that are beneficial for human health. Conventional coconut oil is extracted through refining, bleaching and deodorizing (RBD) processes that has high tendency for contamination and requires extremely hot condition. This disfavored method leads to development of new wet method that produces purest form of coconut oil known as Virgin Coconut Oil (VCO). The present review aims to describe the nutritional and pharmacological benefits gained from the production of VCO. The review aims to summarize the scientific evidences to support folkore claims that VCO could have higher nutritional value over the conventional coconut oil. The review covers the similarities in the pharmacological properties between the conventional and virgin coconut oil, as well as reveals number of pharmacological activities that are newly discovered to have more significant benefits for human health. This could be helpful for future researchers who are intending to investigate the plant nutritional and therapeutic potential to be incorporated in modern medicines sources.

**Keywords:** Virgin coconut oil, pharmacology, MCFA, coconut

## INTRODUCTION

Coconut (*Cocos nucifera*) has been used extensively for food and industrial purposes in several tropical countries of Asia, South and Central America, Africa and the Pacific for a long time. Coconut uses as food sources and in Ayurvedic medicine in India were well documented in Sanskrit 4000 years ago (Kabara 2000). Previous reports showed that in the United States, coconut oil is one of the major sources of dietary fats prior to the advent of the country's edible oil industry since mid of 1940s (Dayrit 2005). Due to the highest economic value of the coconut among the palm family, the coconut trees are often known as the Tree of Life, King of the Tropical Flora, Tree of Abundance and Man's Most Useful Tree (Bawalan & Chapman 2006). Normally, coconut oil is extracted through dry processing. Clean, ground and steamed copra (dried coconut kernel) from which the oil is obtained is pressed by several techniques such as wedge press, screw press or hydraulic press. Then, the oil extracted was subjected to refining, bleaching and deodorising (RBD) processes. Conventional coconut oil that is processed through RBD will be in yellow colour, odourless, tasteless and has low level of natural Vitamin E content as it is exposed to high temperature and various chemical processes throughout RDB processes. This method could not be the best option due to the tendency of contamination by aflatoxin and the requirement of high moisture environment (Guarte *et al.* 1996).

Recently, new wet methods have been developed that the extracted coconut oil does not need to go through the RBD process. Instead, the coconut oil is extracted from the fresh, mature kernel (meat) of the coconut by several natural or mechanical techniques such as centrifugation method, low temperature method, natural fermentation method, pH method or any combinations of these (Raghavendra & Raghavarao 2010; Fabian *et al.* 2007; Villarino *et al.* 2007). Wet methods are more desirable as the final product has not undergone any chemical refining and high temperature environment as well as free from additives (APCC 2003), hence known as Virgin Coconut Oil (VCO). Apart from the remarkable potential as one of the major sources to improve the livelihoods and incomes of small-holder coconut processors, VCO has frequently promoted to provide nutritional and health benefits to human. This paper aims to present an overview on recent published works on the health benefits exhibited by the VCO.

## NUTRITIONAL VALUE: CONVENTIONAL COCONUT OIL VS VIRGIN COCONUT OIL (VCO)

According to Bawalan and Chapman (2006), the coconut kernel has high nutritional value as it contains high content of dietary fat, dietary fibre, protein, carbohydrate, micro minerals such as phosphorus and potassium and vitamins such as riboflavin and niacin. The coconut juice has also been shown to contain nutrients and micro minerals that are beneficial for human health (Radenahmad *et al.* 2010; Yong *et al.* 2009). Che Man and Marina (2006) have shown that the coconut oil is rich in medium chain fatty acids (MCFA) hence enhancing the digestibility in humans. The degree of saturation and length of the carbon chain of the fatty acids determines its properties and effects on human health (Fife 2001). Coconut oil contains the highest percentage of MCFA among other fats and oils and carbon chain length of 8 to 12 carbon atoms. This is the most significant property of coconut oil as the saturated fat does not exhibit gradual softening with increasing temperature. Instead, the conversion from brittle solid to liquid state within a narrow range temperature occurs in immediate time (Bawalan & Chapman 2006).

There are many studies that highlighted the better quality of VCO over the conventionally produced coconut oil (Buderwitz 2013; Dayrit *et al.* 2011; Kamariah *et al.* 2008). Similar to the conventional coconut oil, VCO also rich in medium-chain triglycerides which are resistant to peroxidation. In fact, the type of saturated fatty acids in VCO is highly distinctive from animal fats as the latter consist of mainly long-chain saturated fatty acids. The Philippine National Standard for VCO defines VCO as the purest form of coconut oil as it

appears colourless. It is rich in natural Vitamin E and has not undergone any hydrolytic and atmospheric oxidation demonstrated by the low free fatty acid content (FFA) and low peroxide value (Bawalan & Chapman 2006). Depending on the method of extraction, VCO also produces from mild to strong aroma. Dia *et al.* (2005) have shown in their report although there are some differences in the physiochemical properties of the VCO samples produced by different wet methods, the differences do not significant to affect the overall quality of the VCO. Meanwhile, Marina *et al.* (2009a) described the chemical properties of commercial VCO available in Malaysia and Indonesia. They found that the chemical properties of VCO do not have significant difference from the RBD processed coconut oil. Although there are some differences in iodine, peroxide, saponification and free fatty acid values, the values are still within the specification limit of Codex standard for RBD coconut oil. Also, the fatty acid composition that is dominated by lauric acid with the percentage of 46-48% also is within the limit of VCO standard according to Malaysian Standard (2007) and Asian and Pacific Coconut Community (APCC 2003).

## PHARMACOLOGY PROPERTIES OF VIRGIN COCONUT OIL

### POTENTIALS OF VIRGIN COCONUT OIL AS ANTIOXIDANT

Virgin coconut oil (VCO) which is known as a nutraceutical with notable public awareness about it, has open up new findings that basically disclose new things besides the existence properties of commercial coconut oil. The oil is abundantly consisted of medium chain fatty acids (MCFAs) and shows good consumability. The appreciable attention in the possible effect of consuming dietary phenolics to treat several illness and for human health contribution has generates an opening to find food containing phenolic antioxidants, and VCO is reported as one of the edible oils that has highest total phenolic content, consequently possessed highest antioxidant activity (Mansor *et al.* 2012; Marina *et al.* 2009b) compared to refined coconut oil.

A study by Marina *et al.* (2009c) has determined the phenolic contents of VCO were caffeic, ferulic, p-coumaric, protocatechuic, syringic and vanillic acids and it proposed that the antioxidant activity contribution is related to the phenolic compounds presence. However, phenolic compounds were reclaimed on hot extraction of coconut oil compared to the cold extraction. The antioxidant activity by DPPH assay and deoxyribose assay showed that hot extraction coconut oils was higher than the cold extraction. The study of serum trolox equivalent antioxidant capacity (TEAC) also exhibited better enhancement in the blood serum for rats fed with hot extraction coconut oils compared to the rats with cold extraction. This happened due to the temperature of 100°C used in the study, might be a little too high to show that the coconut oil as virgin and as referring to Codex Standard (2003), the application of heat is allowed in producing virgin oil (Marina *et al.* 2009b).

### VIRGIN COCONUT OIL FOR THE TREATMENT ON METABOLIC DISORDERS

Liau *et al.* (2011) has reported that VCO composed of 70-80% of medium chain fatty acids (MCFAs) compared to other coconut oils. MCFAs are simply oxidized lipids, more rapidly absorbed (Marina *et al.* 2009b) in the intestine although without catalyzation by pancreatic lipase enzyme which carried by the portal vein to the liver, due to not entering the cholesterol cycle and not stored in adipose tissue, thus VCO is an efficacious for weight loss and showed significant use as anti-obesity treatment (Mansor *et al.* 2012). A study has found that efficacy of VCO consumption on reduction of weight especially abdominal fat as showed by waist circumference (WC) reduction. Besides, animal studies using female adult rats showed there is an elevation of HDL level but a reduction of LDL levels and total cholesterol after coconut oil consumption. In addition, the safety of coconut oil consumption is tested especially for organ functions including renal liver function, and also for any biochemical

changes. The results exhibited that all studied parameters did not indicate any elevate from baseline but interestingly a reduction of two biochemical markers which are creatinine and alanine transferase (ALT) levels were indicated after being provided with VCO. Though animal studies did not exhibit similar results as in humans, but this possibility of the various type of coconut oils and dosage used in the test. However, this finding in the humans can not be clarified and needs further investigation (Liau *et al.* 2011).

A study of antidiabetic activity and cholesterol lowering effect of cold pressed virgin coconut oils (CPVCO) are studied by Arumugam *et al.* (2014) showed that reduction of blood glucose, serum total cholesterol, LDL and also triglycerides (TGL) except for HDL. The medium chain fatty acids (MCFAs) and TGL with their fatty acids can oxidized fast and help in weight loss and thus preventing obesity in diabetic obese individuals. The insulin as a control diabetic parameter exhibited a reduction of blood glucose level from 264.20 mg to 221.24 mg for treatment of 3 weeks. Other studies found that plasma lipid profile reduction especially cholesterol with VCO intake. The noticeable reduction in glucose and lipids ascribed to CPVCO due to the presence of antioxidant vitamins. Previous study also showed significant reduction of blood glucose and cholesterol levels of treated groups of rats after 7 weeks of treatment. The significant reduction of blood glucose levels may be credited to the rich lauric acid content with insulin-tropic properties of VCO as reported in isolated islet of mouse. VCO also helps in improving the secretion of insulin, controlling the blood sugar which stimulates the effectual utilization of blood glucose, thus prohibiting and treating diabetes. It has been reported that VCO decrease blood lipid even under normal condition due to affluent concentration of MCFAs which improve metabolism and consequently, inhibits the accumulation of fat in the body. The serum cholesterol, serum triglycerides and LDL were reduced after consumption of 8mL and 10 mL of CPVCO for 30 days.

A study by Arunima and Rajamihan (2012) reported the reduction of cholesterol and triglycerides in serum and tissues with an accretion of HDL cholesterol levels of rats associated with VCO consumption due to unsaponifiable components in hypolipidemic action enables to modify the lipid metabolism. Besides, it is disclosed that phenolic compounds of VCO constitutes higher amounts of caffeic acid, ferulic acid, P-coumaric acid, catechin, vitamin A, vitamin E, tocotrienols and phytosterols compared than copra oil. Tocotrienols are potent in decreasing LDL-cholesterol levels and serum total by excluding HMG-CoA reductase in hepatic enzymic activity through the post-transcriptional mechanism. In addition, an elevated concentration of  $\beta$ -carotene from vitamin A in VCO reduces the lipids content and increases the fecal secretion of bile acids. Besides that, phytosterols inhibits the absorption of cholesterol and elevates fecal excretion of bile acids and neutral sterols competitively for enhancing the circulation of lipid levels to decrease the risk for coronary heart disease. All these bioactive compounds exist in VCO resulted beneficial modifications for performing synergistically in lipid profiles.

## CONCLUSION

Numerous discoveries of VCO benefits in almost all aspects of life including food, industry and health make VCO the newest, highest-value among the coconut products that generates a great deal of interest among the farmers and entrepreneurs. The consumption of VCO as a functional food oil has a long and established history with high demand in medicinal, scientific and nutritional arenas. Till very recently, it is known for its high content of medium chain fatty acids, dietary fats, dietary fibres, proteins, carbohydrate, microminerals and vitamins which in the previous studies had shown beneficial effects on human health in lowering total lipid profiles, preventing cardiovascular and metabolic disease, anti-osteoporosis, anti-obesity, antifungal, antibacterial, antiviral and antioxidant properties. Further studies are needed to be explored to establish the potential applications of effective properties and bioactivities of VCO in different fields.

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